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Remarks

In response to the Examiner's Office Action, Applicant has amended claims 16-22 to overcome the Examiner's objections under Section 112(2).

On prior art, the Examiner has issued anticipation and obviousness rejections based upon Wang U.S. Patent 6,567,688. The Examiner asserts that Wang discloses a system that can be used to obtain ultrasonogram images and thermoacoustic images sequentially, referencing the text bridging cols. 14 and 15 of the Wang patent.

Applicant initially notes that the Wang patent specification primarily discloses a system that utilizes an mechanically scanned array of focused transducer elements: two- or three-dimensional images are created from the assembly of one dimensional lines of data, in which each pixel is generated from the output of a single focused transducer. See, e.g., Wang's abstract: "[e]ach time-domain signal from the ultrasonic transducer is converted to a one-dimensional image along the acoustic axis of the ultrasonic transducer. Scanning the system perpendicularly to the acoustic axis of the ultrasonic transducer generates multi-dimensional images in real time *without computational image reconstruction*."¹ [emphasis added]

¹ Notably, "computational reconstruction" is specifically what is involved in a backprojecting process such as is used for thermoacoustic computed tomography or TCT as disclosed herein.

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The Wang patent does not describe the use of an unfocused transducer with backprojection methods to capture thermoacoustic images. Indeed, the discussion cited by the Examiner in the text bridging cols. 14-15 specifically states that an image is created with focused transducer, in lines (“[b]oth images measure the same line defined by the ultrasonic axis”). As is clarified in col. 15 at lines 17-19, a “time-domain echo signal [is] converted into a one-dimensional image along the acoustic axis.”

There is a discussion in Wang of the use of unfocused ultrasonic transducers, e.g. at col. 2 line 49, 6 lines 37-57, and claims 28 and 39. In each case, however, the text refers to the use of synthetic aperture, not backprojection, to monitor echo signals, i.e., without a backprojection.

Turning now to a comparison with the present invention, the present specification notes (page 6, lines 16 et seq.) that “[p]hotoacoustic images were reconstructed using a filtered-backprojection algorithm described in the above-referenced U.S. Patents. [See page 1, line 12] To implement this algorithm, the first derivative of the recorded photoacoustic signals for each transducer element and each angle were back-projected over circular arcs centered at each transducer element’s location. Two-dimensional images were reconstructed on a 256 x 256 grid of 0.1-mm pixels.”² For ultrasound imaging, conventional ultrasound methods are used, via

² For greater detail, the Examiner may refer to the referenced U.S. Patent 5,713,356. The ‘356 patent discloses a tomographic method for generating thermoacoustic imaging that involves

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the “Acuson 128 XP ultrasound imaging system” (see Fig. 7, “128 XP”). The referenced system utilizes phased beam steering techniques to produce a focused beam along a linear path from an array of ultrasonic transducers.

Turning to the claims at issue herein, the Examiner will note that each requires “a backprojection algorithm to generate a representation of acoustic signals generated at points within the tissue, the representation for a point being based upon signals from plural detectors in said detector array”, and at the same time, states that ultrasound imaging is generated by “beam steering”. These two uses for the transducers are recited within the claims, whereas Wang does not teach “backprojection” and in fact teaches away from the use of computational methods for reconstruction, by showing a focused transducer or an array of transducers that are used together as a synthetic aperture – in either case creating a line of data rather than a reconstruction by backprojection that would involve the use of plural measured signals to reconstruct a pixel.

In view of the lack of “backprojection” in the cited Wang patent and the lack of any suggestion to combining backprojection with beam steering on an imaging system, Applicant submits that all claims herein are allowable and requests early transmission of a Notice of Allowability.

combining signals from plural detectors via backprojection.

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A three month extension of time is required to accompany this communication.

Please apply the extension of time fee to Deposit Account 23-3000. If any other charges or credits are necessary to complete this communication, please apply them to Deposit Account 23-3000.

Respectfully submitted,

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